

WHAT IS CLAIMED IS:

1. A compound semiconductor stacked structure having a first compound semiconductor layer, an active layer, and
5 a second compound semiconductor layer, which are successively stacked on a substrate, wherein

said first and second compound semiconductor layers are each a compound semiconductor layer having Sb and at least two of five elements consisting of Al, Ga, In, As and P;

10 said active layer consists of a compound semiconductor with a composition represented by $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{Sb}_{1-y}$ ($0.8 \leq x \leq 1.0$, $0.8 \leq y \leq 1.0$);

said first and second compound semiconductor layers each have a band gap greater than that of said active layer,
15 and a resistance at least five times greater than that of said active layer;

lattice constant differences between said active layer and said first and second compound semiconductor layers are set within a range of 0.0% to 1.2%; and

20 said active layer is thicker than 30 nm and thinner than 100 nm.

2. The compound semiconductor stacked structure as claimed in claim 1, further comprising a third compound
25 semiconductor layer that is represented by $\text{In}_w\text{Ga}_{1-w}\text{As}$ ($0 \leq w \leq 1$), and stacked on said second compound semiconductor layer.

3. The compound semiconductor stacked structure as claimed in claim 1, wherein said active layer is InAs.
- 5 4. The compound semiconductor stacked structure as claimed in claim 1, 2 or 3, wherein said first and second compound semiconductor layers are each composed of $\text{Al}_z\text{Ga}_{1-z}\text{As}_y\text{Sb}_{1-y}$ ($0.0 \leq z \leq 1.0$, $0.0 \leq y \leq 0.3$).
- 10 5. A magnetic sensor comprising electrodes formed on said active layer of said compound semiconductor stacked structure as defined in any one of claims 1-4.
6. Mobile equipment using the magnetic sensor as defined
15 in claim 5.
7. The mobile equipment as claimed in claim 6, wherein said mobile equipment is a mobile phone.
- 20 8. A Hall device comprising:
semiconductor thin films including an active layer composed of $\text{In}_{x1}\text{Ga}_{1-x1}\text{As}_{y1}\text{Sb}_{1-y1}$ ($0 \leq x1 \leq 1$, $0 \leq y1 \leq 1$), and compound semiconductor layers that are formed on and under said active layer, and that each have a band gap greater
25 than that of said active layer;
a metal electrode layer; and
a passivation, wherein

said metal electrode layer makes contact only with said active layer, and a top surface and side surfaces of said semiconductor thin films other than the contact surface are directly covered with said passivation.

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9. The Hall device as claimed in claim 8, wherein said compound semiconductor layers are each including Sb.

10. The Hall device as claimed in claim 9, wherein the
10 compound semiconductor layer formed on said active layer has at least two layers, and a surface layer of them is composed of $\text{In}_{x_2}\text{Ga}_{1-x_2}\text{As}$ ($0 \leq x_2 \leq 1$).

11. The Hall device as claimed in claim 8, 9 or 10, wherein
15 said semiconductor thin films are formed on a substrate composed of GaAs or Si, said active layer is composed of InAs, and said compound semiconductor layers are each composed of $\text{Al}_{z_1}\text{Ga}_{1-z_1}\text{As}_{y_2}\text{Sb}_{1-y_2}$ ($0 \leq z_1 \leq 1$, $0 \leq y_2 \leq 0.3$).

20 12. A Hall device comprising:

semiconductor thin films having an active layer composed of $\text{In}_{x_1}\text{Ga}_{1-x_1}\text{As}_{y_1}\text{Sb}_{1-y_1}$ ($0 \leq x_1 \leq 1$, $0 \leq y_1 \leq 1$), and compound semiconductor layers that are formed on and under said active layer and that each have a band gap greater than that of
25 said active layer;

a metal electrode layer; and

a passivation, wherein

the compound semiconductor layer formed on said active layer has at least two layers, and a surface layer of them is composed of $\text{In}_{x_2}\text{Ga}_{1-x_2}\text{As}$ ($0 \leq x_2 \leq 1$).

5 13. A Hall device comprising:

amagneto-sensitive pattern with a multilayer structure that includes an active layer composed of an $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{Sb}_{1-y}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$) layer greater than 30 nm and less than 100 nm in film thickness, and compound semiconductors
10 sandwiching the active layer, wherein

input resistance $R \times$ sensitivity V_h is equal to or greater than 20 [$\Omega \cdot \text{V}$] under conditions that an input voltage is 1 V, and applied magnetic field is 50 mT.

15 14. The Hall device as claimed in claim 13, wherein said active layer has its upper and lower layers composed of Sb and at least two of five elements of Al, Ga, In, As and P.

20 15. A pointing device using the Hall device as defined in claim 13 or 14.

16. An open/close detection switch using the Hall device as defined in claim 13 or 14.

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17. A geomagnetic direction sensor using the Hall device as defined in claim 13 or 14.

18. A fabrication method of a Hall device comprising the steps of:

forming semiconductor thin films including an active
5 layer composed of $\text{In}_{x_1}\text{Ga}_{1-x_1}\text{As}_{y_1}\text{Sb}_{1-y_1}$ ($0 \leq x_1 \leq 1$, $0 \leq y_1 \leq 1$), and compound semiconductor layers that are formed on and under said active layer, and that each have a band gap greater than that of said active layer;

exposing said active layer by etching the compound
10 semiconductor layers on regions at which a metal electrode layer is to be formed; and

forming a passivation subsequently such that it covers the entire semiconductor thin films.

15 19. The fabrication method of the Hall device as claimed in claim 18, further comprising the steps of:

etching said semiconductor thin films except for a magneto-sensitive pattern and electrode contact regions using the patterned passivation as a mask; and

20 covering with a second passivation said substrate and side surfaces of said semiconductor thin films exposed by the etching step, and said passivation.

20. A fabrication method of a Hall device comprising the
25 steps of:

forming semiconductor thin films including an active layer composed of $\text{In}_{x_1}\text{Ga}_{1-x_1}\text{As}_{y_1}\text{Sb}_{1-y_1}$ ($0 \leq x_1 \leq 1$, $0 \leq y_1 \leq$

1), and compound semiconductor layers that are formed on and under said active layer, and that each include Sb, and that each have a band gap greater than that of said active layer;

5 forming a first passivation after the step of forming said semiconductor thin films;

 removing by etching said semiconductor thin films except for a magneto-sensitive pattern and electrode contact regions using the patterned first passivation as a mask;

10 and

 covering with a second passivation said substrate and said semiconductor thin films exposed by etching, and said first passivation.

15 21. A fabrication method of a Hall device comprising the steps of:

 forming semiconductor thin films including an active layer composed of $\text{In}_{x1}\text{Ga}_{1-x1}\text{As}_{y1}\text{Sb}_{1-y1}$ ($0 \leq x1 \leq 1$, $0 \leq y1 \leq 1$), and compound semiconductor layers that are formed on and under said active layer, and that each include Sb, and that each have a band gap greater than that of said active layer;

 forming a first passivation after the step of forming said semiconductor thin films;

25 removing by etching said semiconductor thin films except for a magneto-sensitive pattern and electrode contact regions using the patterned first passivation as a mask;

exposing said active layer making contact with said metal electrode layer by removing said first passivation and upper compound semiconductor layer by etching;

covering with a second passivation said substrate and
5 said semiconductor thin films exposed by etching, and said first passivation;

exposing said active layer by patterning said second passivation; and

forming said metal electrode layer.

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22. A fabrication method of a Hall device comprising the steps of:

forming semiconductor thin films including an active layer composed of $\text{In}_{x1}\text{Ga}_{1-x1}\text{As}_{y1}\text{Sb}_{1-y1}$ ($0 \leq x1 \leq 1$, $0 \leq y1 \leq$
15 1), and compound semiconductor layers that are formed on and under said active layer, and that each include Sb, and that each have a band gap greater than that of said active layer;

forming a first passivation after the step of forming
20 said semiconductor thin films;

removing by etching said semiconductor thin films except for a magneto-sensitive pattern and electrode contact regions using the patterned first passivation as a mask; and

25 covering with a second passivation said substrate and said semiconductor thin films exposed by etching, and said first passivation;

exposing said active layer making contact with said metal electrode layer by removing said first and second passivation and upper compound semiconductor layer by etching;

5 covering said semiconductor thin films and said second passivation, which are exposed by etching, with a third passivation;

exposing said active layer by patterning said third passivation; and

10 forming said metal electrode layer.

23. The fabrication method of the Hall device as claimed in any one of claims 18-22, wherein said first passivation is composed of SiO_2 , and said second passivation is composed
15 of Si_3N_4 .

24. The fabrication method of the Hall device as claimed in any one of claims 18-22, wherein said semiconductor thin films are formed on the substrate composed of GaAs or Si,
20 said active layer is composed of InAs, and said compound semiconductor layers are each composed of $\text{Al}_{Z1}\text{Ga}_{1-Z1}\text{As}_{Y2}\text{Sb}_{1-Y2}$ ($0 \leq Z1 \leq 1$, $0 \leq Y2 \leq 0.3$).